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Metal Composition And Essential Nutrient Analysis In Various Colours Of Lentils Determination Of Levels Of Essential Nutrients And Compositional Analysis Of Metals In Lentil.

Gopala Krishna Devisetty*, Omima Abatashi, Umaima Salim, and Zainab Said.

Department of Applied Sciences, Section-Chemistry, Higher College of Technology, Muscat-Post box no 74, PIN-133, Sultanate of Oman.

ABSTRACT

The study was conducted with the objectives of analysed and evaluating of lentil varieties for haulm nutritional values. The concentrations of trace essential metals (Na, K, Co, Cu, Fe, Mn, Ni and Zn) in lentil samples were determined by Flame atomic absorption spectrometry and Atomic absorption spectrometry. The accuracy of the method was checked by the standard addition method.

Keywords: Lentils and Metal composition, Essential nutrients.

**Corresponding author*

INTRODUCTION

Lentils are becoming increasingly popular and important sources of vegetable protein. Lentil seed contains 25% protein, 1.1% fat, 59% carbohydrate, and is also rich in important vitamins, minerals, and soluble and insoluble dietary fiber. High protein content (22 to 34.6%) and 55% starch, low level of anti-nutrients, high fiber content and ability to grow in low water stress conditions are the main attributes that make lentils important legume crops. Lentils also contain significant amounts of mineral elements like Ca, Mg, Fe, Mn, Cu, Co, Ni, B and Se.

Lentils accumulate metals at different levels depending upon environmental conditions. Many plants are found to take up large quantities of certain elements from the environment and are said hyper accumulators of Metals. Trace elements play important roles in chemical, biological, biochemical, metabolic, catabolic and enzymatic reactions in the living cells of plants, animals and human beings. Cobalt is essential component of vitamin B₁₂; zinc is found in several enzymes and involved in genetic material transcription. Copper is a key component of redox enzymes and nickel has a role in metabolic activities. Iron is vital in oxygen transport and also enables metabolism. Manganese is a component and activator of a number of enzymes. Glycosyl transferase enzymes are specifically activated by manganese.

Lentils are high in fiber and complex carbohydrates, while low in fat and calories. Their high protein content makes lentils a perfect option for those looking to boost their protein intake. They are naturally gluten-free, making them a delicious staple in a gluten-free kitchen. Their exceptionally low glycemic index (low GI) values and resistant starch content make them suitable for a diabetic diet [1-8].

Types: Brown Lentils–This variety cooks quickly (in about 20 minutes) and requires no soaking like most other beans. With a subtle and earthy flavour, this variety is good for soups, stews, salads, pilafs, and more. These small, brown lentils hold their shape well during cooking but may become mushy if overcooked.

Green Lentils– These light green lentils are quite large and tend to be slightly flatter than other varieties. Green lentils are very flavourful, remain fairly firm and retain their shape with cooking. This makes them ideal for salads and pilafs as they will not easily break down with mixing or stirring.

French Green Lentils French green lentils, Puy lentils smaller and darker than regular green lentils and appear slightly speckled on the surface. This variety of lentil remains firm and requires an extended cooking time of approximately 40 minutes.

Yellow Lentils: Yellow lentils are sweet and nutty and have a reddish interior flesh. These lentils break down quickly with cooking and therefore are better suited for dishes that require thickening. Yellow lentils are popular in Indian “dal” recipes where the lentils are cooked down to a smooth puree.

Red Lentils: Red lentils are yellow lentils that have been hulled and split. They are a light red to orange colour, small in size, and create a very smooth puree when cooked. Because they have been hulled and split, red lentils are also the quickest cooking variety.

Black/Beluga Lentils: Black lentils are small and quite round in shape. They are often called beluga lentils because they resemble beluga caviar when cooked. Although the hull is dark black in colour, the flesh is light and creamy.

Table 1: Essential elements and their benefits

Minerals	Benefits
Potassium	Essential to your cells' ability to function, helping them to produce energy
Calcium	Maintaining your skeleton It helps in bone, teeth and muscle growth. It protects against cancer. It treats of high blood pressure.
Iron	Iron is an essential part of haemoglobin; that transports oxygen through our bodies.

	It responsible for producing energy. It protects renal failure.
Zinc	Acts as an antioxidant, building up the body's immune system It helps stimulate the activity of at least 100 different enzymes. It plays a major role in growth and development of human body. It supports the action of the immune system.
Magnesium	Helping to create essential enzymes for building bones. It regulates the heartbeat and prevents its flocculation. It protects against weak bound. Enhances body immunity and increases its ability to resist disease.
Copper	Essential for healthy blood, bones and brains.
Sodium	Water balance: it helps to regulate fluid levels in the human body. Channels are what pump water into the cell and regulate the amount of extra cellular fluid in the body. Brain function: the brain is very sensitive to change in sodium levels of the body. Eliminates excess carbon dioxide: sodium removes any excess carbon dioxide. Regulate glucose absorption: it helps in transportation of nutrients in the body cell membranes.

Levels of metals content in the analyzed lentil samples for human consumption

The concentrations of the essential metals Mn, Fe, Ni, Co, Cu and Zn and heavy metals Cd and Pb in the different lentil samples were determined as shown in Table 2.

Cadmium: The permissible limit for cadmium in foods is 0.05g kg⁻¹.

Cobalt: The safety limit for human consumption of cobalt is 0.05 to 1 mg/day for humans.

Copper: The acceptable limit for human consumption of copper is 10 ppm.

Iron: The acceptable limit for human consumption of iron is 8 to 11 mg/day for infants as well as adults.

Nickel: The prescribed safety limit of Nickel is 3 to 7 mg/day in humans. In this study, the contents of Nickel are below the safety limit.

Zinc: The acceptable limit for human consumption of zinc is 150 ppm.

Manganese: The recommended intake of Mn from food; water and dietary supplements should not exceed the tolerable daily upper limit of 11 mg/day.

MATERIALS AND METHODS

Analyses of Physicochemical Properties: The three kind of lentils used in this study were commercial varieties which were collected from market. The analyses involve the estimation of pH Electrical conductivity, and carbohydrates, Smell and Appearance of the Lentils were carried out in the present study.

Determination of Mineral composition: The elements were extracted from the Lentils by the wet digest method. The digested sample was analysed for the elemental composition using Atomic Absorption Spectrophotometer (AAS) and Flame Emission Spectrophotometer (FES), UV-Visible spectrophotometer. Zn, Fe, Mn, Cu, Mg, Na, K and Ca were determined and the concentrations of the elements were presented in mg/L.

RESULT AND DISCUSSION

The results of Physicochemical Properties and Mineral Composition are presented in Table 2.

Table 2: Mineral composition of Lentils

Metal	Added	Concentration (mg/100g)					
		Orange		Black		Yellow	
		Found	Recovery (%)	Found	Recovery (%)	Found	Recovery (%)
Cd	0.0	0.012		0.09		0.08	
	5.0	4.61	92.2	4.63	92.6	4.66	93.2
Co	0.0	0.28		0.24		0.23	
	5.0	4.76	95.5	4.73	94.6	4.78	95.6
Cu	0.0	0.22		0.28		0.25	
	5.0	4.97	93.9	4.93	98.6	4.98	99.6
Fe	0.0	6.50		5.26		6.28	
	5.0	4.89	97.8	4.93	98.6	4.97	99.4
Mn	0.0	5.83		4.69		6.23	
	5.0	4.78	95.6	4.81	96.2	4.93	98.6
Ni	0.0	0.32		0.28		0.26	
	5.0	4.91	98.2	4.93	98.6	4.95	99.2
Zn	0.0	6.23		5.59		5.26	
	5.0	4.89	97.8	4.91	98.2	4.93	98.6
Carbohydrates (ppm)		64.6		45.5		33.2	

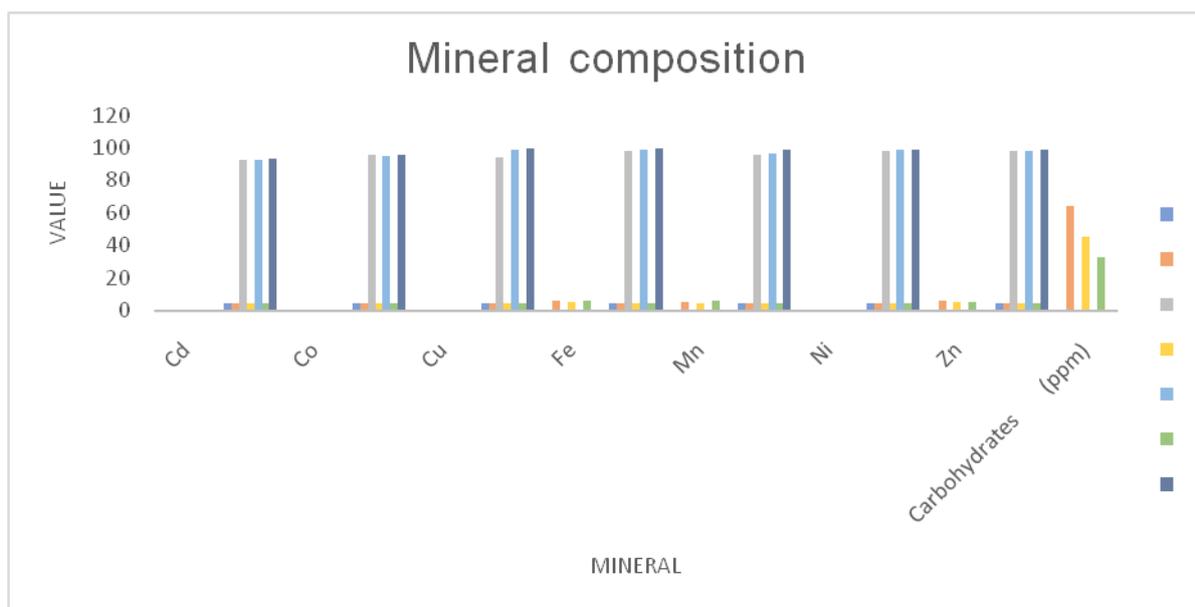


Figure: Mineral composition of Lentils

Author’s contribution statement: Gopala Krishna Devisetty Planned entire study, designed the analysis and wrote the OmimaAbatashi, Umaima Salim, Zainab Said collected the data and performed the analysis.

Statistical analysis: The analysis of variance of the data obtained was done by using completely randomized design (CRD) for different studies. The analysis of variance revealed at significance of P < 0.05 level is mentioned wherever required.

CONCLUSION

Present study has shown that the locally available lentils contain safe levels of nutritional elements for human consumption and are free from heavy metals contamination. The study also indicates that the lentils

are rich source of some minerals and nutrients. An efficient and simple digestion procedure was developed for the analysis of lentil flour and validated by the standard addition method.

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